



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/567,729

02/01/2006

Kazutoshi Kojima

OGOSH46USA

7682

270 7590 03/31/2009

HOWSON & HOWSON LLP
501 OFFICE CENTER DRIVE
SUITE 210
FORT WASHINGTON, PA 19034

EXAMINER

SALERNO, SARAH KATE

ART UNIT

PAPER NUMBER

2814

MAIL DATE

DELIVERY MODE

03/31/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/567,729	Applicant(s) KOJIMA ET AL.	
	Examiner SARAH K. SALERNO	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 December 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,6,28 and 32-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,6,28 and 32-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicant's amendment/arguments filed on 12/01/08 as being acknowledged and entered. By this amendment claims 2-5, 7-27 & 29-31 are canceled, no new claims have been added, claims 1, 6, 28 & 32-34 are pending and no claims are withdrawn.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 contains the limitation "said substrate being a silicon carbide substrate having a flat surface and a 4H crystal structure" which does not coincide with previous claim 18 and 21 as well as the instant applications specification. This limitation, based on previous claim limitations and applicant's remarks is going to be interpreted as the silicon carbide epitaxial wafer having a flat surface and the silicon carbide substrate having a 4H crystal structure.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section

Art Unit: 2814

351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1 and 34 are rejected under 35 U.S.C. 102(e) as being anticipated by Ellison et al. (US PGPub 2006/0011128)

Claim 1: Ellison teaches a silicon carbide epitaxial wafer which is formed on a substrate that is less than 1° off from the {0001} surface of silicon carbide having an a-type crystal structure, said silicon carbide epitaxial wafer being formed on a {0001} C face of the substrate and said substrate being silicon carbide substrate having a flat surface and a 4H crystal structure and further comprising a semiconductor device formed on said silicon carbide epitaxial wafer ([0007, 0010, 0012-0015, 0020-0021, 0035 and 0049].

Claim 34: Ellison teaches the silicon carbide epitaxial wafer has the same 4H α -type crystal structure as the silicon carbide substrate.

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

7. Claims 1 and 34 are rejected under 35 U.S.C. 102(a) as being anticipated by Nakamura et al., "Surface Mechanisms in Homoepitaxial Growth on alpha-SiC {0001}-vicinal Faces;" Silicon Carbide and Related Materials; Material Science Forum; 2003; pages 163-168.

Claim 1: Nakamura teaches a silicon carbide epitaxial wafer which is formed on a substrate that is less than 1° off from the {0001} surface of silicon carbide having an a-type crystal structure, said silicon carbide epitaxial wafer being formed on a {0001} C face of the substrate and said substrate being silicon carbide substrate having a flat surface and a 4H crystal structure and further comprising a semiconductor device formed on said silicon carbide epitaxial wafer (whole document).

Claim 34: Nakamura teaches the silicon carbide epitaxial wafer has the same 4H α -type crystal structure as the silicon carbide substrate.

8. Claim 1 and 34 are rejected under 35 U.S.C. 102(a) as being anticipated by Kojima et al., "4H-SiC Carbon-Face Epitaxial Layers Grown by Low Pressure Hot-Wall Chemical Vapor Deposition;" Silicon Carbide and Related Materials 2003; pages 209-212; Volumes 457-460; Trans Tech Publications; Switerland.

Claim 1: Kojima teaches a silicon carbide epitaxial wafer which is formed on a substrate that is less than 1° off from the {0001} surface of silicon carbide having an a-type crystal structure, said silicon carbide epitaxial wafer being formed on a {0001} C face of the substrate and said substrate being silicon carbide substrate having a flat surface and a 4H crystal structure and further comprising a semiconductor device formed on said silicon carbide epitaxial wafer (whole document).

Claim 34: Kojima teaches the silicon carbide epitaxial wafer has the same 4H α -type crystal structure as the silicon carbide substrate.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 6, 28 & 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kojima et al., "4H-SiC Carbon-Face Epitaxial Layers Grown by Low Pressure Hot-Wall Chemical Vapor Deposition;" Silicon Carbide and Related Materials 2003; pages 209-212; Volumes 457-460; Trans Tech Publications; Switerland. in view of Wagner et al. "Surface preparation of 4H-SiC substrates for hot-wall CVD of SiC layers;" Applied Surface Science 184; 2001; pages 55-59)

Claim 6: Kojima teaches a manufacturing method of a silicon carbide epitaxial wafer, comprising the steps of:

cleansing a surface of a silicon carbide substrate with a mixed gas of hydrogen at 1400°C to 1600°C to provide the substrate with a surface step of a height of 1nm or less;

epitaxially growing silicon carbide on a {0001} C face of the substrate that is less than 1° off from the {0001} surface of silicon carbide having an α-type crystal structure, silicon carbide substrate having a 4H crystal structure (whole document).

Kojima does not teach the mixed gas of hydrogen and propane. Wagner teaches a cleansing step before a SiC epitaxial growth that uses a mixed gas of hydrogen and propane to adjust SiC substrate roughness (whole document). Therefore it would have

Art Unit: 2814

been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method taught by Kojima to include the cleansing step with hydrogen and propane to adjust substrate roughness and taught by Wanger (whole document)

Claim 28: Kojima teaches a manufacturing method of a silicon carbide epitaxial wafer, comprising the steps of:

cleansing a surface of a silicon carbide substrate with a mixed gas of hydrogen at 1400°C to 1600°C to provide the substrate with a surface step of a height of 1nm or less;

epitaxially growing silicon carbide on a {0001} C face of the substrate that is less than 1° off from the {0001} surface of silicon carbide having an a-type crystal structure, silicon carbide substrate having a 4H crystal structure (whole document).

during said epitaxially growing step, using a source gas of silane and propane having a compositional ratio of C and Si of 1 or less and a growth pressure of 250mbar or less.

Kojima does not teach the mixed gas of hydrogen and propane. Wagner teaches a cleansing step before a SiC epitaxial growth that uses a mixed gas of hydrogen and propane to adjust SiC substrate roughness (whole document). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the method taught by Kojima to include the cleansing step with hydrogen and propane to adjust substrate roughness and taught by Wanger (whole document)

Claim 32: Kojima teaches wherein the silicon carbide epitaxially grown on the silicon carbide substrate has the same 4H α -type crystal structure as the silicon carbide substrate.

Claim 33: Kojima teaches wherein said step of epitaxially growing silicon carbide on the silicon carbide substrate produces homoepitaxially grown silicon carbide of the same 4H α -type crystal structure as the silicon carbide substrate.

Response to Arguments

11. Applicant's arguments with respect to claims 1, 6, 28 and 32-34 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SARAH K. SALERNO whose telephone number is (571)270-1266. The examiner can normally be reached on M-F 8:00-4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. K. S./
Examiner, Art Unit 2814

/Theresa T. Doan/
Primary Examiner, Art Unit 2814